

Chapter Five

COST BENEFIT ANALYSIS (CBA) AND COST MINIMIZATION ANALYSIS (CMA)

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OBJECTIVE

Upon completing this chapter, you will be able to:

- Define and describe CBA and CA
- Discuss the methods of measuring productivity and intangible costs
- Identify advantage and disadvantages of both CBA and CMA
- Explain the two methods of presenting CBA results
 - net benefit Vs benefit to cost ratio

INTRODUCTION

- CBA is a method that allows for the identification, measurement, and comparison of the benefits of an intervention with costs incurred to achieve this benefit
- CBA measures both the costs and the outcomes in monetary terms
 - compares intervention costs to the monetary value of outcomes
 - determines whether benefits are greater than cost
- Standardizes all costs and benefits in monetary terms.

INTRODUCTION . . .

- it is difficult to determine the monetary value of health outcomes of an intervention, therefore, CBA is usually employed to evaluate clinical services or programs rather than individual patient t/t
 - usually the perspective of CBA is societal
- one of the applications of PE is to justify or evaluate clinical services/programs
 - should a new pharmacy service be implemented?
 - is an immunization or vaccine plan cost-beneficial?
- Although clinical pharmacy programs have shown improvements in clinical outcomes, financial pressures are forcing decision makers to consider the following questions:
 - Do the benefits of a program or intervention outweigh the costs?
 - Which program will provide the greatest benefit?
- CBA is a tool that can be used to address these questions

INTRODUCTION

- CBA is an evaluation method for comparing the monetary value of all resources consumed (costs) in providing a program or intervention with the monetary value of the outcome (benefit) from that program or intervention
- The first use of CBA in health care dates back to the 1960s. CBA of vaccination
- **Costs:** including those of implementing an intervention.
- **Benefits:** including those resulting from an intervention, such as medical costs averted, productivity gains, and the monetized value of health improvements.

CBA: ADVANTAGE AND DISADVANTAGE

Advantage:

- Allows comparison of programs or interventions with entirely different outcomes/objectives as long as outcomes are measured in monetary units.
- Benefit-to-cost ratios can be ranked, and programs with similar, as well as dissimilar, outcomes can be compared
- can be used when comparing programs with different objectives (different types of outcomes), because all benefits are converted into common monetary units
- – it uses summary measure such as net benefit or benefit/cost ratio which includes all benefits and costs in monetary term

DISADVANTAGES:

- It ignore intangible costs (pain, anxiety stress).
- Difficulty in converting some nonmonetary units into monetary terms (only considers direct benefits and costs)
 - Number of medication errors avoided
 - Years of life saved and Quality of Life ?
- placing economic values on medical outcomes is difficult

DIFFERENCE WITH OTHER ANALYSIS

- The main difference between cost benefit analysis and other methods of economic evaluation is that it seeks to place monetary values on both inputs (costs) and outcomes (benefits) of the health care .
- Among other things, this enable the monetary returns on investments in health to be compared with the return obtainable from investments in other areas of the economy

EXAMPLE: CEA vs CBA

TABLE . COMPARISON OF COST-EFFECTIVENESS RATIOS AND BENEFIT-TO-COST RATIOS^a

<i>Program or Intervention</i>	<i>Cost-Effectiveness Ratio</i>	<i>Benefit-to-Cost Ratio</i>
AIDS prevention and awareness program	\$230,000/case prevented	8.4:1
Vaccination program for children	\$104,000/case prevented	0.3:1
Smoking cessation intervention	\$3,700/quit	6.7:1
Diabetes medication adherence program	\$67/normoglycemic patient	15.1:1
Breast cancer screening program	\$50,000/life year saved	2.4:1

CBA PURPOSE

- To determine if it's sound decision.
- To provide basis for comparing total expected costs of each options against total expected benefit relative to other alternatives.
- See if benefit out ways cost and by how much.
- To offer a baseline for comparing projects by determining which project's **benefits** are greater than its **costs**

STEPS IN CONDUCTING CBA

Step 1: Program: Determine the type of program or intervention to be considered.

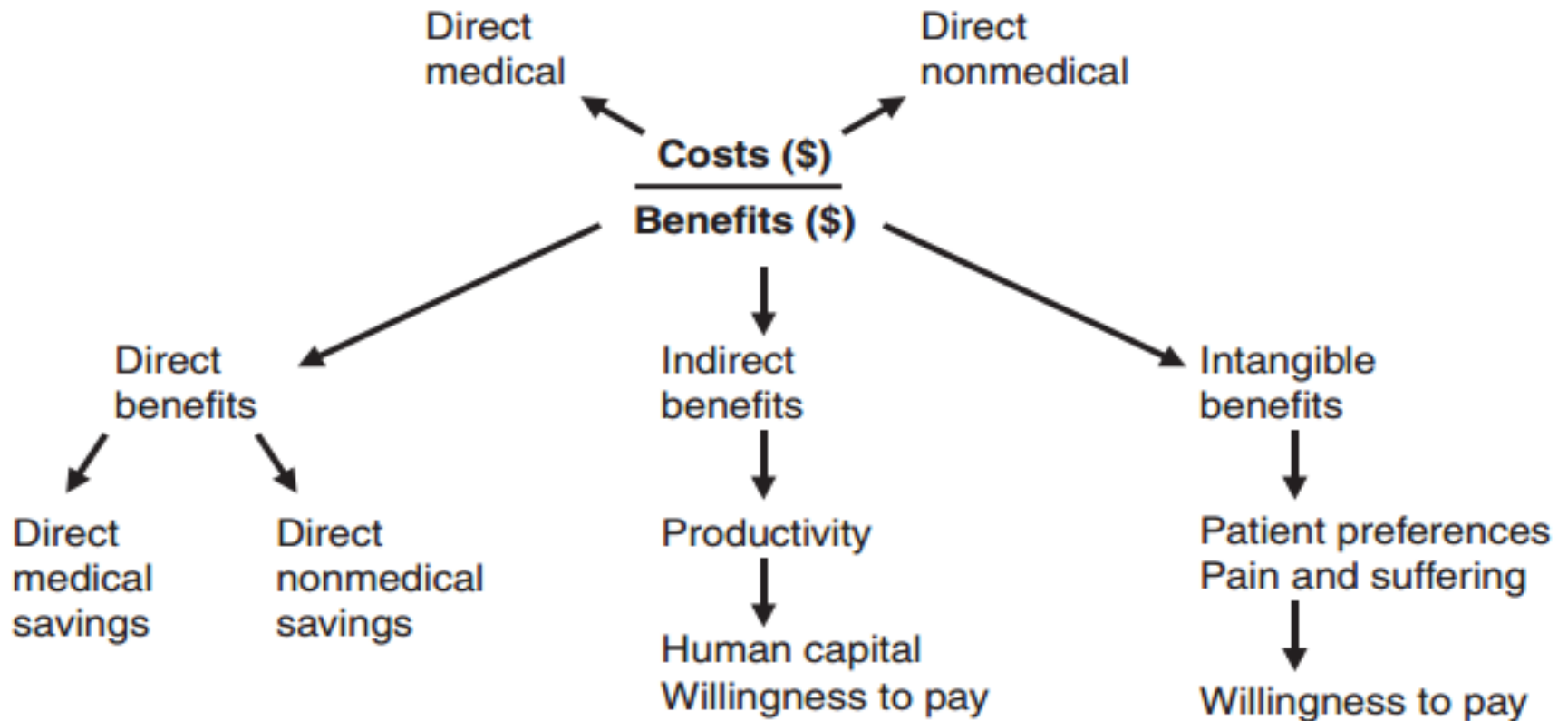
Step 2: Alternative: Identify alternatives, clinical pharmacist like to start an asthma clinic/ no asthma clinic, diabetics clinic.

Step 3: Identify the costs and Benefits: identify the costs and benefits
Cost analysis including willingness-to-pay (WTP) (eg. CBHI for Programs)

Step 4. Perspective: Determine the perspective of the study. Note: economists recommend CBAs should be conducted from the societal perspective

Step 5. Calculate: Calculate results of costs and benefits

COMPONENTS OF CBA



MEASURING INDIRECT AND INTANGIBLE COSTS

- Indirect benefits are increases in productivity or earnings as a result of a program or intervention
- Intangible benefits are monetary values of reductions in pains and suffering as a result of a program or intervention
- There are different methods to estimate indirect benefits
- The two most commonly used methods are:
 - **The human capital approach and**
 - **The willingness to pay approach**

HUMAN CAPITAL METHOD APPROACH

- The HC method is used to estimate morbidity and mortality costs (wage and productivity losses) based on an individual's earning capacity using standard labor wage rates
- Estimates wage and productivity losses because of illness/disability/death.
- There are two basic components to calculate indirect benefits using HC:
 - Wage rate:(income/day/yr)
 - Missed time (days/yr) because of illness or death.

HCM: WAGE RATE CALCULATIONS

- Depending on the type of study, a yearly wage rate or a daily wage rate can be calculated
- Yearly wage rate; is income per year
 - used for a program or intervention that would reduce long-term disability or death
- for example, a pneumococcal vaccination program might result in preventing premature death
 - thus, it is appropriate to use a yearly wage rate
 - the value of the number of years saved because of the intervention will be calculated to determine indirect benefits
- Daily wage rate
 - income per year divided by number of days worked per year
 - used for a program or intervention that would reduce short-term disability.
- a person with a chronic disease may not be adversely affected by the disease state on a continual basis, but he may have short-term periodic disability

NUMBER OF DAYS WORKED PER YEAR IS CALCULATED AS FOLLOWS:

$$\begin{aligned} \text{average work days per year} &= \text{number of days in a year} - \text{number of weekend days} - \text{number of vacation days} - \text{number of sick-leave days} \\ &= 365 - 104 - 21 - 7 \\ &= 233 \text{ days} \end{aligned}$$

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HCM: MISSED TIME BECAUSE OF ILLNESS

- To calculate indirect benefits using yearly wage rate, the number of years missed/lost because of illness or premature death must be determined
- To calculate indirect benefits using daily wage rate, the number of missed days because of illness must be determined
Missed days because of illness can be categorized as missed work day and restricted activity day.

ADVANTAGES AND DISADVANTAGES OF THE HC METHOD

- Measuring indirect benefits using the HC approach has several advantages.
- It is fairly straightforward and easy to measure. Income estimates can be obtained or estimated from publicly available sources, and days lost from illness can be readily obtained from the patient or another secondary source.
- **The HC approach also has several disadvantages.** The primary concern with using the HC approach is that it may be biased against specific groups of people,
- Namely unemployed individuals. It assumes that if a person is not working, he or she has little or no economic benefit. Children and unemployed elderly individuals are two groups with which bias can occur.
- The HC assumption that the value of health benefits equals the economic productivity they permit may also be biased. The earnings for some individuals.

EXAMPLES

- **Example 1:** Assume that the population served by an asthma clinic is made up of adults with an average annual income of \$4,660 and 233 days worked per year. An average of 40 days a year were missed from work before participating in the asthma clinic, and an average of 10 days a year were missed from work after participating in the asthma clinic.
 - Determine:
 - a. the value of lost productivity before participating in the asthma clinic
 - b. the value of lost productivity after participating in the asthma clinic
 - c. the indirect benefit or the cost savings per person of the asthma clinic service

EXAMPLES

- **Solution:** since asthma has short-term periodic disability, We use daily wage rate rather than yearly wage rate to determine the value of lost productivity
- Daily wage rate = average yearly income
number of days worked per year
= \$4,660/233 days = \$20/day

Daily Wage Rate	Average Number of Missed Days per Year
Before: \$20	40
After: \$20	10

EXAMPLES ...

A) Lost productivity before participating in the asthma clinic = daily wage rate x number of missed days before participating. = \$20/day x 40 days = \$800

- the value of 40 days lost from work is \$800

B) lost productivity after participating in the asthma clinic
= daily wage rate x number of missed days
= \$20/day x 10 days = \$200

- the value of 10 days lost from work is \$200

c) Cost savings/indirect benefit

Indirect benefit per person = \$600. this is the monetary value of increased productivity

Cost savings/indirect benefit	= the value of 40 days - the value of 10 days lost from work = 800 - 200 = 600
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EXAMPLES ...

Daily Wage Rate	Average Number of Missed Days per Year	Average Value of Lost Productivity (\$)
Before: \$20	40	800
After: \$20	10	200

WILLINGNESS-TO-PAY METHOD

- WTP method can be used to estimate the monetary value of both the indirect and intangible aspects of a disease or condition
- A technique which aims to assign a value to health benefits by directly eliciting individual preferences in the views of samples of the general public who are asked how much they would be prepared to pay to accrue a benefit or to avoid certain events.
- This method determines how much people are willing to pay for a given health outcome intangible benefits are estimated using WTP
- Incorporates patient preferences and intangible benefits such as quality of life differences.
- In this method the respondent is asked to value a contingent or Hypothetical market, direct method used to elicit the values or the WTP amounts.

WILLINGNESS-TO-PAY...

- Measuring WTP using the CV method should include two general elements, a **hypothetical** scenario and a **bidding vehicle**
- To estimate WTP values, respondents are:
 - presented with a hypothetical market describing the benefits of a particular intervention
 - then asked to value the intervention in a monetary amount
- The WTP includes two general elements:
 - a hypothetical scenario and
 - a bidding vehicle
- **Hypothetical Scenario:** should include a description of the health care program or intervention
 - the purpose of the scenario is to provide the respondent with an accurate description of the good or service that he or she is being asked to value

WILLINGNESS-TO-PAY METHOD....

- the hypothetical scenario should detail
 - the benefit of the intervention
 - the amount of time the person should expect to spend
- **An example of a hypothetical scenario for asthma clinic is presented: Asthma Clinic Hypothetical Scenario**
 - patients with asthma have improved their condition by learning more about their disease and by taking their medications as directed
 - pharmacists can help you understand your condition and the medications used to treat it
- in addition, pharmacists can:
 - help you learn how to use a peak flow meter and an inhaler
 - help you better manage the medications used to treat asthma
 - help you recognize and handle situations when asthma attacks occur
 - monitor your asthma by keeping a record and a regular follow up to assess your progress
 - this type of service would last approximately 1 hour
 - the program would result in a 50% improvement in your asthma

BIDDING VEHICLES

- After the program or intervention has been adequately described, respondents are then asked to “bid,” or place a value on the program or intervention
- Bids can be obtained through a variety of formats, such as open ended questions, closed-ended questions, or a payment card
- Open-ended questions. **Example:** what is the maximum amount that you would be willing to pay for a 1-hour consultation with a pharmacist? _____
- close ended questions: **Example:** would you be willing to pay \$60 for a 1-hour consultation with a pharmacist? Yes
No

PAYMENT CARD

- The payment card method provides the respondent with a list of possible WTP amounts to choose from. **Example:** What is the maximum amount that you would be willing to pay for a 1-hour consultation with a pharmacist? Please circle your choice.

\$150 \$90 \$30

\$130 \$70 \$10

\$110 \$50 \$0

ADVANTAGES AND DISADVANTAGES OF THE WILLINGNESS-TO-PAY METHOD

- The main advantage of the WTP approach is that it is a method to place a dollar value on intangible benefits. It is also grounded in welfare economic theory, which embodies patient preferences and choice.
- However, there are several disadvantages to the WTP methodology. Many critics question the validity of the WTP responses because of the various methods used to elicit dollar values as well as the hypothetical nature of the health care benefit. It is difficult for people to place a dollar value on a health benefit or an increase in health-related quality of life or satisfaction.
Because a “hypothetical” or artificial scenario is presented, it is possible that respondents might give a “hypothetical response” or that the respondent may not

CALCULATING RESULTS OF COSTS AND BENEFITS

After all costs and benefits have been identified and quantified, the results of the analysis must be presented in ways that help decision makers understand the value of the program or intervention. CBA can be presented in the following three formats:

- **Net benefit or net cost:**

- Net benefit = total benefits - total costs;
- Net cost = total costs - total benefits.
- interventions are cost-beneficial if $NB > 0$ or $NC < 0$

- **Benefit-to-Cost (Cost-to-Benefit) ratio:**

- Total benefit/Total cost.
- Intervention is cost beneficial if $B/C > 1$ Or $C/B < 1$

- **Internal rate of return(IRR):**

- IRR is the rate of return that equates the present value (PV) of benefits to the PV of costs. The goal is to find the rate of return than costs and benefits equal. After IRR is calculated, it is compared with a specified hurdle rate. accept all projects with an IRR greater than the hurdle rate.

EXAMPLE

Suppose a decision maker had to choose between two proposals for implementation. Also assume that the projects are for 1 year, so discounting is not needed.

- Proposal A: Cost = ETB 1,000; Benefit = ETB 2,000
- Proposal B: Cost = ETB 5,000; Benefit = ETB 7,500

COMPARISON OF TWO PROPOSALS

	<i>Proposal A</i>	<i>Proposal B</i>
Net benefit	$\$2,000 - \$1,000 = \$1,000$	$\$7,500 - \$5,000 = \$2,500$
Net cost	$\$1,000 - \$2,000 = -\$1,000$	$\$5,000 - \$7,500 = -\$2,500$
Benefit/cost ratio	$\$2,000/\$1,000 = 2.0$	$\$7,500/\$5,000 = 1.5$
Cost/benefit ratio	$\$1,000/\$2,000 = 0.5$	$\$5,000/\$7,500 = 0.7$

- Using the criteria outlined above for cost-beneficial programs, both programs are cost-beneficial using both the net and ratio methods of calculations.
- However, when comparing net calculations, proposal B is more cost beneficial than proposal A (net benefit \$2,500 versus \$1,000), but proposal A is more cost-beneficial than proposal B (benefit-to-cost ratio 2.0 versus 1.5) when using ratio calculations.
- Thus, the ratio and the net calculation may indicate that different options are the most beneficial.

CALCULATING COST AND BENEFIT

- Example 1: Suppose you are interested in determining whether a pharmacokinetic monitoring service is economically beneficial to your organization. One year after the service was implemented, a CBA was performed, and result of the costs and benefits of the service over the first year.

Cost categories	Amount of cost (\$)	Health outcome	Benefit/monetary value of health outcome (\$)
Salaries	90,000	Reduction in length of stay	250,000
Office supplies	10,000	Fewer days of IV therapy, including IV supplies	50,000
Total	100,000		300,000

- a) calculate the net benefit of the pharmacokinetic service
- b) calculate the benefit to cost ratio of the pharmacokinetic service
- c) how would you interpret the cost/benefit ratio calculation result?
- d) is the pharmacokinetic service cost beneficial?

CALCULATE...CONT'D

- a) Net benefit = total benefit – total cost
= \$300,000 - \$100,000 = \$200,000
- b) Benefit- to- cost ratio = total benefit/total cost
= \$300,000/\$100,000 = 3:1
- c) Interpretation of benefit to cost ratio result (3:1):
For every 1 dollar spent, the pharmacokinetic service has a return of 3 dollars

EXAMPLE 2

Suppose a decision maker had to choose between two proposals for implementation.

- Proposal A: Cost = \$1,000; Benefit = \$2,000

- proposal B: Cost = \$5,000; Benefit = \$7,500

- a. compare the two proposals using net and ratio calculations

- b. how much would be the return from each project?

INTERNAL RATE OF RETURN

- The internal rate of return (IRR) is the rate of return that equates the **present value** (PV) of benefits to the PV of costs (see Chapter 3 for PV calculations).
- The goal is to find the rate of return that would make the costs and benefits equal.
- After the IRR is calculated, it is compared with a specified **hurdle rate**. The decision rule for IRR is to accept all projects with an IRR greater than the hurdle rate. If the IRR is greater than the hurdle rate, then it means that the project can yield a higher rate of return compared with some other investment. For example, the IRR should be higher than the interest rates available for savings accounts or secured bonds

IRR CALCULATION

- Assume that the IRR for the asthma pharmaceutical care program is 6.3%.
- If the market rate of return is 4.5% for other investments, this is the hurdle rate.
- Because 6.3% exceeds 4.5%, the pharmaceutical care program should be chosen because it will yield a greater return, or greater value for every dollar invested.

Example of an IRR calculation

- $NPV = 0$; or $PV \text{ of future cash flows} - \text{Initial Investment} = 0$; or
 - $CF_1 + \frac{CF_2}{(1+r)} + \frac{CF_3}{(1+r)^2} + \dots - \text{Initial Investment} = 0$
- Where,
 - r is the internal rate of return,
 - CF_1 is the period one net cash inflow,
 - CF_2 is the period two net cash inflow,
 - CF_3 is the period three net cash inflow, and so on.

WHAT IS A HURDLE RATE?

- A hurdle rate is the minimum rate of return on a project or investment required by a manager or investor.
- It allows companies to make important decisions on whether or not to pursue a specific project.
- The hurdle rate describes the appropriate compensation for the level of risk present—riskier projects generally have higher hurdle rates than those with less risk.
- In order to determine the rate, the following are some of the areas that must be taken into consideration: associated risks, cost of capital and the returns of other possible investments or projects.

EXAMPLE....

- Find the IRR of an investment having initial cash outflow of \$200,000. The cash inflows: Year 1 = \$60,000; Year 2 = \$100,000; and Year = \$75,000 respectively.
- **Solution:** Assume that r is 10%.
 - NPV at 10% discount rate = $\$193,539 - \$200,000 = -\$6,461$
 - Since NPV is less than 0 we have to decrease discount rate, thus NPV at 6% discount rate = $\$208,575 - \$200,000 = \$8,575$ But it is greater than 0 we have to increase the discount rate, thus NPV at 8% discount rate = $\$200,826 - \$200,000 = 1826$ close to 0
- $IRR \approx 8\%$

COST MINIMIZATION ANALYSIS

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COST MINIMIZATION ANALYSIS

- Cost-minimization analysis (CMA) measures and compares input costs, and assumes outcomes to be equivalent
- It is the simplest of the four types of pharmacoeconomics analyses
- compares two or more interventions considered equally effective
- determines which intervention costs less

USE OF CMA

- Used to compare:
 - Brand vs. generic drugs
 - Two or more drugs in same therapeutic class with similar side effect profiles
- Results of CMA are expressed as cost/patient treated
- Costs include more than drug acquisition cost
- CMA shows only a “cost savings” of one intervention over another

USE OF CMA CONT'D...

- Costs should extend beyond a comparison of drug acquisition costs and include costs of drug preparation (pharmacist and technician time), administration (nursing time), and storage, physician visits, number of hospital days, and pharmacokinetic consultations
- The least expensive agent, considering all these costs, should be preferred
- CMA has been used frequently, and its application could expand given the increasing number of “me too” products and generic competition in the pharmaceutical marketplace

EXAMPLE

- Example 1: the following is monthly t/t cost for low molecular weight heparin (LMWH such as **dalteparin**, **enoxaparin**) and heparin. They are assumed to be therapeutically equivalent. Which one would you recommend?



	LMWH	Heparin
Monthly acquisition drug cost	\$72.20	\$27.09
Monthly Monitoring cost	\$0	Five tests per patient (\$12.4*5)
Total t/t cost	\$72.20	\$89.09

EXAMPLE 2

- The following is monthly t/t cost of selected oral antidiabetic drugs. They are assumed to be therapeutically equivalent.
 - a. Which one is recommended?
 - b. How much is the cost saving of using Diabeta over Glynase?

Drug	Total monthly cost
Glyburide (Diabeta)	\$22.50
Glyburide (Mirconase)	\$29.25
Glyburide (Glynase)	\$24.75

APPLICATION, ADVANTAGE, DISADVANTAGE OF CMA

○ Common Applications

- Cost comparison of two generic medications rated as equivalent by FDA
- Cost comparison of same drug therapy in different settings
 - Not appropriate for comparing different classes of medications

○ Advantage: simplest analysis to conduct

○ Disadvantage: cannot be used when outcomes of each intervention are not equivalent

○ this method has limited use because it can only compare alternatives with the same outcomes

End of Chapter Four